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the Allegheny mountains. Their geological position down in the coal measures also adds to their scientific value. We have not given so detailed a description of them as is necessary for identification of species, as some of them will go to Yale College, and there be compared with their large collection, and Prof. Marsh will then proceed to assign their true paleontological character and name them. I have compared them with known footprints of the Connecticut valley, and have been surprised at their apparent resemblance; yet, when we recollect that those are *triassic*, while ours are in the middle of the coal measures, it seems most probable that they are generically distinct, and will add new races to the earliest air-breathing animals of our globe.

REPORT ON THE BOTANY OF KANSAS FOR THE YEAR
1873.

BY J. H. CARRUTH.

During the past year I have devoted what time I could spare from other duties to a further examination of the Plants of Kansas, and herewith give the result. Some cases doubtful last year have been solved, and I have become acquainted with twenty or more of those given last year on the authority of Professors Snow and Hall.

The past year our corps of observers has been much increased. In addition to Prof. Snow, we have had Prof. Wherrell, of Leavenworth; Dr. Saunders, of Lawrence; Mr. Popenoe, of Topeka; and Dr. Watson, of Ellis; to whom the proper credits will be given. The latter gentleman has given thirteen, none of which are found in Wood's Class Book or Gray's Manual.

It is sometimes asked: Of what use is botany to a farmer? I have repeatedly known persons to set out wild grape vines, and look two or three years for fruit, when the blossoms had stamens or male organs only, and could never produce fruit. Some grape vines from seed have perfect blossoms; that is, both stamens and pistils, and some have stamens only. But vines from cuttings always have the same kind of blossoms as the vine they were taken from.

A man once set a large garden full of strawberry plants, nearly all of which had pistils, or female organs only. He had plenty of blossoms, but no fruit. By putting a sufficient number of either perfect or staminate plants among them, he might have had fruit.

A lady once cut off the "false blossoms," staminate ones, from

her cucumber vines, to make them bear better. She should have known that these were just as necessary as the others. A botanist knows how to keep different varieties of corn, melons, etc., from intermixing and degenerating.

Last summer Dr. Wright, of Penn Yan, New York, wrote me that he had seen in a New York paper a statement that a grass or grasses in Kansas never produced seed. He did not believe it, but wished to know whether I knew of any such grass. I replied that every plant in favorable circumstances produced seed, but if the soil, climate or season were unfavorable, and especially if the plant also produced tubers, it might seldom produce seed. From time immemorial (to me), my father had in his garden a dense thicket of artichokes, *Helianthus tuberosus*. They never blossomed till I cultivated some of them in hills like potatoes. Sweet potatoes seldom or never blossom in this climate, but doubtless they do in their native place. Some varieties of common potatoes seldom or never blossom; others blossom, but produce no seed; while others produce seed abundantly. I have noticed that those varieties which have "balls" have poor, watery potatoes.

A patch of wild rice in a wet basin near Osawatomie sent up no flower stalks for seven years, and then it had them twelve feet high.

The three most common and valuable prairie grasses of Kansas, some years produce only leaves, except in some favored spots.

Buffalo grass, so called in Miami county, seldom or never blossoms, but doubtless it does further west.

Some pear trees and plum trees blossom abundantly, but never bear fruit; probably from a lack of something in the soil that is needed to perfect the fruit.

Plants not in the Class-book nor Manual, are marked thus; * immigrants thus. †

ADDITIONS TO THE CATALOGUE OF THE PLANTS OF KANSAS FOR THE YEAR 1873.

RANUNCULACEÆ.

- Clematis*, Virgin's Bower.
C. Pitcheri: One specimen
Anemone, Wind Flower.
A. patens or *Nuttalliana*. Western Kansas. Snow.
Ranunculus, Crowfoot.
R. recurvatus. Lawrence and Leavenworth. Snow.
R. fascicularis. Wakarusa woods. Snow.

NYMPHÆACEÆ.

- Nymphaea*, White Water Lily.
N. odorata. Southern Kansas. Prof. Mudge.

FUMARIACEÆ.

- Corydalis*.
C. aurea, variety *flavula*. Lawrence. Snow.
C. montana. Lawrence, Snow. Topeka, Popenoe.

CRUCIFERÆ.

- Nasturtium*, Water-cress.
N. sylvestre. Lawrence, rare.
Dentaria, Pepper Root.
D. laciniata. Wakarusa.
Cardamine, Bitter Cress.
C. rhomboidea. Leavenworth. Wherrell.
Arabis, Rock-cress.
A. Canadensis. Vinland.

Brassica and Sinapis, Cabbage and Mustard.
†B. arvensis. Field Mustard. Snow.

Lepidium, Peppergrass.

*L. intermedium. Lawrence. Saunders.

Vesicaria, Bladder-pod.

*V. Fendleri. Ellis. Watson.

CAPPARIDACEÆ.

Cleome, Spider Flower.

*C. integrifolia. Leavenworth, T. E. Wilcox,
U. S. A.; also Topeka, Popenoe.

VIOLACEÆ.

Viola, Violet.

V. sagittata. Lawrence, one specimen. Snow.

CARYOPHYLLACEÆ.

Agrostemma, Corn Cockle.

†A. Githago. Topeka. Popenoe.

Cerastium, Mouse-ear Chickweed.

C. nutans. Lawrence. Not abundant.

Arenaria, Sandwort.

*A. stricta. Ellis. Watson.

MALVACEÆ.

Callirrhoe, Mallow.

*C. involucrata. Salina; also Russell Co.
Snow.

Malvastrum.

*M. coccineam. Abundant in Central and
Western Kansas. Snow.

GERANIACEÆ.

Geranium, Crane's Bill.

G. maculatum. Leavenworth. Wherrell.

BALSAMINACEÆ.

Impatiens, Touch-me-not.

I. fulva. Topeka. Popenoe.

POLYGALACEÆ.

Polygala, Milkwort.

*P. alba. Ellis. Watson.

LEGUMINOSÆ.

Vicia, Vetch.

*V. linearis. Common at Lawrence. Snow.

Lathyrus, Sweet Pea, etc.

*L. linearis. Ellis. Watson.

[Are these two the same?]

Trifolium, Clover.

T. procumbens. Yellow Clover. Topeka,
Popenoe.

†T. arvense. Topeka, one specimen, Popenoe

Astragalus, Milk Vetch.

*A. multiflorus. Ellis. Watson.

Oxytropis.

*O. Lambertii. Western Kansas. Snow.

Glycyrrhiza, Licorice.

*G. lepidota. Lawrence. Also sent from
Marshall county by W. J. McLaughlin.
Abundant in alkali lands. Snow.

Hoffmanseggia.

*H. Jamesii. Western Kansas. Sent by
Prof. Mudge.

ROSACEÆ.

Pyrus, Apple, etc.

P. angustifolia. Lawrence. Snow. I think
I found the same, but could hardly make
it agree.

Rosa, Rose.

*R. ———. Lawrence. Referred to last year
as a variety. Mr. Wood thinks it distinct.
Stem strigous, 18 high; leaflets mostly 9;
flowers corymbose, about 10; fruit mostly
conical.

LYTHRACEÆ.

Cuphea, Cuphea.

C. viscosissima. Near Osawatomie.

ONAGRACEÆ.

Eurotia, Evening Primrose.

*E. lavendulæfolia. Ellis. Watson.

Gaura.

*G. virgata. Lawrence. Snow. Probably
the same as G. linifolia given last year
from Eaton.

Ludwigia, Bastard Loose-strife.

L. alternifolia. Leavenworth. Wherrell.

L. palustris. Lawrence. Saunders.

Myriophyllum, Water Milfoil.

M. scaberrimum. Lake four miles from Law-
rence.

CACTACEÆ.

Opuntia, Prickly Pear.

*O. vulgaris, var. Rafinesquii. Lawrence.
Saunders.

SAXIFRAGACEÆ.

Heuchera, Alum Root.

H. hispida. Lawrence. Snow. Also Leav-
enworth. Wherrell.

UMBELLIFERÆ.

Cicuta, Water Hemlock.

C. maculata. Lawrence.

Cryptotaenia, Honewort.

C. Canadensis. Lawrence. Snow.

Æthusa, Fool's Parsley.

Æ. cynapium. Lawrence. Snow.

COMPOSITÆ.

Liatis.

L. cylindracea. Lawrence. Saunders.

Aster, Aster.

A. sagittifolius. Lawrence. Saunders.

Diplopappus, Double-bristled Aster.

*D. ericoides. Ellis. Watson.

Solidago, Goldenrod.

S. virgata. Miami county.

S. speciosa, var. rigiduscula. Topeka.
Popenoe.

Heterotheca.

H. scabra. Lawrence, one specimen. Snow.

Eclipta.

E. procumbens, erecta and alba, var. brachy-
pod. Lawrence. Saunders.

Silphium, Rosin-weed.

S. laevigatum. Lawrence. Common.

*S. aspernum. Lawrence. Snow.

Heliopsis, Ox-eye.
H. lævis. Type of which var. scabra is more common. Lawrence. Saunders.

Echinacea, Purple Cone-flower.
*E. atوروبens. Lawrence. Occasional.

Rudbeckia, Cone-flower.
R. triloba. Lawrence.
R. hirta. Lawrence. Snow.

Lepachis.
*L. pulcherrima, var. of columnaris. Lawrence. Saunders.

Helianthus, Sunflower.
H. trachelifolius. Lawrence. Saunders.

Gutierrezia.
G. Euthamiae? [T. and A.] Mr. Wood says: Genus certain, species doubtful — ray pappus uniformly wanting. He suggests the name G. heteropappus. Roadsides. Eudora and Paola. Fifteen inches high, branching above; flowers bright yellow.

Cirsium, Thistle.
C. Virginianum. Lawrence. Saunders.
Krigia, Dwarf Dandelion.
K. Virginica. Lawrence, one specimen, Snow

Hieracium, Hawkweed.
H. Gronovii. Lawrence. Snow.
H. paniculatum. Lawrence. Snow.

LOBELIACEAE.
Lobelia, Lobelia.
L. spicata. Topeka. rare. Popenoe.

CAMPANULACEAE.
Specularia.
*S. leptocarpa. Lawrence, one specimen. Snow.

PLANTAGINACEAE.
Plantago, Plantain.
P. lanceolata. Lawrence, one place; also Topeka, Popenoe.

OROBANCHACEAE.
Conopholis [Wallroth]; Philipea [Don.] Squaw Root.
C. Ludoviciana. From W. J. McLaughlin, Marshall county. Snow.

SCROPHULARIACEAE.
Linaria, Toad-flax.
*L. vulgaris. Roadside, Lawrence.
Pentstemon, Beard-tongue.
P. grandiflorus. Russell county, abundant. Snow. Also Lawrence. Saunders.
P. pubescens. Various places. The P. Digitalis of last year.

Conoclea.
C. multifida. Osawatomie. Also Lawrence. Snow.
Veronica, Speedwell.
V. Anagallis. One place seven miles southwest of Lawrence.

Castilleja, Painted Cup.
*C. pallida. Ellis. Watson.

LABIATAE.

Scutellaria, Skullcap.
*S. Drummondii. Lawrence, rare. Snow.
S. lateriflora. Sent from Marshall county by S. D. Mauk. Snow.

Stachys, Hedge Nettle.
S. palustris. One place five miles east of Lawrence.
S. sylvatica. Lawrence, one specimen, Snow. [S. sylvatica, Nutt., S. Nuttalliana, Shuttlew.]

BORAGINACEAE.

Ethinospermum, Bur-seed.
*E. Redowskii. Ellis. Watson.

CONVOLVULACEAE.

Cuscuta, Dodder.
C. tenuiflora. Lawrence. Saunders.
C. Gronovii. Lawrence, common. Snow.

ASCLEPIADACEAE.

Asclepias, Milkweed.
A. Sullivantii. Wakarusa bottom. More social than other species.
A. Vaseyi. One place.
*A. ———. Lawrence. Several specimens. Mr. Wood cannot find its name. Stem slender, 2" diam., 15' high, pubescent; leaves opposite, lanceolate, sessile, round at base, acute at apex; 2' long, 10' wide; umbel one, terminal, nodding peduncle 1'-2'.

ARISTOLOCHIACEAE.

Asarum, Wild Ginger.
A. Virginicum. Lawrence. Woods.

POLYGONACEAE.

Polygonum, Knot Grass, etc.
P. maritimum. Lawrence. Occasional.

CHENOPODIACEAE.

Cycloloma.
*? C. ———. A specimen was on exhibition at the state fair from southwestern Kansas, 2½ ft. broad, and 15 inches high, with a short stem one or two inches in diameter. The leaves had fallen off; the fruit was smaller than on specimens found here.

EUPHORBIACEAE.

Acalypha, Three-seeded Mercury.
A. gracilis. Lawrence. Saunders. A. gracilens, Gr. same as A. Virginica, E.?

URTICACEAE.

Parietaria, Pellitory.
P. Pennsylvanica. Lawrence.

JUGLANDACEAE.

Juglans, Walnut.
J. cinerea, Butternut. Lyon Co. Popenoe.
Carya, Hickory.
C. aquatica. Common. Known by leaflets resembling peach leaves.
C. microcarpa. Near Osawatomie. The bark is nearly black.

- C. ———. Little trees found near Clinton. Leaflets about 9, closely sessile, obovate-lanceolate, and strongly cordate at base. If this is the *C. amara*, this point should be noticed.
- CUPULIFERAE.
Quercus, Oak.
- Q. falcata, Spanish Oak. Lawrence and Willow Springs.
- SAURURACEÆ.
Saururus, Lizard-tail.
- S. cernuus. Lawrence, one specimen. Snow.
- NAIADACEÆ.
Najas, Water Nymph.
- N. flexilis. Lake four miles north Lawrence.
- Potamogeton, Pond-weed.
- P. natans. Lake. The one foretold last year.
- P. pectinatus. Lake. All three abundant.
- ALISMACEÆ.
Sagittaria, Arrow-head.
- S. variabilis, var. *gracilis*, leaves narrow, same lake. Also var. *obtusifolia* and *sagittæ-folia*, very common, distinguished by Dr. Saunders.
- Echinodorus.
- E. rostratus. Lake, abundant. Snow.
- HYDROCHARIDACEÆ.
Anacharis, Ditch Moss.
- A. Canadensis. Lawrence. Saunders.
- AMARYLLIDACEÆ.
Hypoxis, Star-grass.
- H. filifolia. Topeka. Popenoe.
- SMILACEÆ.
Smilax, Greenbrier.
- S. tamnifolia. Lawrence. Snow.
- LILIACEÆ.
Allium, Onion.
- *A. reticulatum. (?) Ellis. Watson.
- PONTEDERIACEÆ.
Heteranthera.
- H. reniformis. Lawrence. Saunders.
- JUNCACEÆ.
Juncus, Rush.
- J. tenuis. Lawrence; very common.
- J. megacephalus, or J. nodosus, var. *megacephalus*. Lawrence. Common.
- J. scirpoides, var. *echinatus*. Lawrence.
- CYPERACEÆ.
My cyperaceæ were mostly examined by Dr. S. H. Wright, of Penn Yan, N. Y. Prof. Snow's are undoubtedly correct.
- Cyperus, Galingale.
- C. phymatodes. Lawrence.
- C. Michauxianus. Lawrence. Saunders.
- C. inflexus. Lawrence.
- C. inflexus, var. *thrice longer*. Lawrence.
- C. acuminatus. Lawrence.
- C. compressus. Lawrence.
- Eleocharis, Spiked Rush.
- E. palustris. Lawrence.
- E. tricostata. Near Eudora.
- E. olivacea. Lake.
- E. tenuis. Lawrence.
- Scirpus, Bulrush.
- S. debilis. Lawrence.
- S. fluviatilis. Water.
- S. polyphyllus. Lawrence, common. Snow.
- S. lineatus. Lawrence.
- Fimbristylis.
- F. spadicea. Lawrence.
- Trichelostylis.
- T. autumnalis? Lawrence.
- T. capillaris? Lawrence.
- Carex, Sedge.
- I give the names in Wood's Botanist and Florist, and in the order of that book. Where the names given me were different, I give both names.
- C. vulpinoidea. Lawrence.
- C. stipata. Leavenworth. Wherrell.
- C. cephalophora. Lawrence.
- C. rosea. Leavenworth. Wherrell.
- C. scoparia. Lawrence.
- C. cristata. Lawrence.
- C. straminea. Lawrence.
- C. festucacea. Lawrence. Snow.
- C. adusta. Lawrence.
- C. stricta. (*acuta*.) Lawrence. Snow.
- C. Davisii. Lawrence.
- C. stenolepis. Lawrence. Snow.
- C. laxiflora. Lawrence. Snow.
- C. granularis. Lawrence.
- C. panicea. Lawrence.
- C. Meadii. Very common in Eastern Kansas. Snow.
- C. Hitchcockiana. Leavenworth. Wherrell.
- C. lanuginosa (*pellita*.) Lawrence. Snow.
- C. polymorpha. Lawrence. Snow.
- C. riparia (*lacustris*.) Lawrence. Snow.
- C. ampullacea (*utriculata*.) Lawrence. Saunders.
- GRAMINEÆ — GRASSES.
- The gramineæ given below were all found near Lawrence, except as otherwise given:
- Leersia, False Rice.
- L. oryzoides, Cut Grass.
- Agrostis, Bent Grass.
- A. vulgaris, Red Top.
- A. alba, White Bent, Bonnet Grass.
- A. elata, Taller Thin Grass.
- Sporobolus, Drop seed Grass.
- S. cryptandrus.
- Cinna, Sweet Reed Grass.
- C. arundinacea. River bank near Osawatomie.
- Muhlenbergia, Drop-seed Grass.
- M. glomerata.

- M. diffusa. Alongside walks and in shady places covering the ground. Leaves very short and nearly at right angles with the stem.
- *M. ———. River bank, Osawatomie. Mr. Wood cannot find the same. He thus describes it: "Slender, glabrous, branching; one foot high; panicle erect, capillary, loose, branches in 3's and 5's, whorled. Spikelets scarcely 1" long, much shorter than their pedicels. *Glumes pointed, rough on the keel, the upper one shorter, but longer than the two equal obtuse 3-veined pales*, which have a few short beards at their base. Comes nearest to M. Mexicana, but is decidedly different by the characters italicized."
- Calamagrostis, Reed Bent-grass.
- C. Canadensis, Blue Joint. One place, Waka-rusa bottom.
- Paspalum.
- P. fluitans. Mostly under water. Osawatomie.
- Panicum, Panic Grass.
- P. proliferum.
- P. agrostoides.
- P. viscidum. Snow and Saunders.
- Bromus, Brome Grass.
- B. secalinus, Chess.
- B. mollis, Downy Chess.
- B. ciliatus.
- Tricuspis.
- T. (Uralepis) purpurea.
- Dactylis, Orchard Grass.
- D. glomerata.
- Festuca, Fescue Grass.
- F. ovina, Sheep's Fescue.
- F. pratensis, Meadow Fescue.
- F. elatior.
- Eatonia.
- E. obtusata.
- Melica, Melic Grass.
- M. mutica. Scattered, tall, conspicuous.
- Eragostis.
- E. reptans. Riverbank, Osawatomie.
- E. purshii.
- E. erythrogona. Seen once.
- Poa, Spear Grass.
- P. compressa.
- P. sylvestris. Both have flattened stems.
- Glyceria, Manna Grass.
- G. nervata.
- G. maritima.
- Triticum, Wheat.
- T. violaceum. Distinct from T. repens or or Couch Grass.
- Leptochloa.
- L. mucronata. Osawatomie.
- Eleusine, Yard Grass.
- E. Indica. Yard of Presbyterian church, Lawrence.
- Buchloe, Buffalo Grass.
- *B. dactyloides. Ellis. Watson.
- A grass called by this name grows near Osawatomie, but it seldom or never blossoms, so that it would require close observation to determine it. It grows in stools as Buffalo grass is said to, and is of about the same size.
- Filices, Ferns.
- Polypodium. Polypody.
- P. incanum. Burlington. Mrs. J. N. Locke.
- Aspidium, Shield Fern.
- A. spinulosum, var. Boottii. Lawrence. Saunders.
- HEPATICAEE.
- Marchantia.
- *M. polymorpha. Saunders.
- Species added, about 175.
- Not east of Mississippi, about 27.
- LAWRENCE, KANSAS, Dec., 1873.

SPECULATIONS IN REGARD TO COMETS' TAILS.

BY F. W. BARDWELL.

Of all questions in Astronomy pressed conspicuously upon notice, none seem to elude the grasp of the scientist with more subtlety than that of the character and composition of comets' tails. From Copernicus to Newton, from Newton to Le Verrier and to the spectroscopist of to-day, are seen a series of brilliant triumphs. The Ptolemaic epicycles have vanished into the simplest of curves; the multitudinous array of celestial orbs follow each other with infinite precision and never-ending succession, according to laws comprehensible